MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

PCL0016 - CALCULUS

(ALL groups)

1 JUNE 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This examination paper consists of **3 pages** (including the cover page) with **6 questions only.**

2. **Attempt ALL questions.**

3. Please write all your answers in the Answer Booklet provided. **Show all relevant steps** to obtain the maximum possible marks.

Question 1

(a) Evaluate the limits, if they exist.

(i) $\lim_{x\to\pi} 3(x-\pi)^2(2-x)$ [2 marks]

(ii) $\lim_{x\to+\infty} \dfrac{\sqrt{x^4+1}}{x^3-2}$ [3 marks]

(iii) $\lim_{x\to1} \cos\left(\dfrac{x^2-1}{x-1}\right)$ [5 marks]

(b) Find $\lim_{x\to2}[f(x)-g(x)]$ if $f(x)=\dfrac{x^2+6-6}{x-2}$ and $g(x)=1$. [5 marks]

(c) For what values of k is the following function continuous at every x?

$$\phi(x)=\begin{cases} kx^2 & , \quad x\le 2 \\ 2x+k & , \quad x>2 \end{cases}$$

[5 marks]

Question 2

(a) Differentiate $g(x)=\dfrac{(2\sqrt{x}+1)(x-1)}{x+3}$. [5 marks]

(b) Given $x\sin y - x^3 = \pi$, find dy/dx by using implicit differentiation. [4 marks]

(c) Use a local linear approximation to estimate the value of $\sqrt[4]{257}$ to 3 d.p. [6 marks]

Question 3

The following polynomial function is given:

$$f(x)=3x^4-4x^3+2.$$

(a) Find the y-intercept of the graph of f, if it exists. [1 mark]
(b) Find the interval(s) on which f is increasing or decreasing. [4 marks]
(c) Find the interval(s) on which f is concave up or concave down. [4 marks]
(d) Identify and classify the relative extrema of f. [3 marks]
(e) Sketch the graph of f. [3 marks]

Continued...

Question 4

(a) Evaluate the following integrals:

(i) $\int (1+\sin t)^9 \cos t \, dt$ [3 marks]

(ii) $\int xe^{3x} dx$ f [3 marks]

(iii) $\int_1^3 (2x-1)^3 dx$ [3 marks]

(b) Using partial fraction decomposition, show that the rational function

$$f(x) = -\frac{2x^2+x+2}{x^2(x+1)}$$

can be written in the form

$$\frac{1}{x} - \frac{2}{x^2} - \frac{3}{x+1}.$$ [4 marks]

Hence, determine $\int f(x)dx$. [2 marks]

Question 5

A region R is bounded by $f(x) = \frac{1}{2} + x^2$ and $g(x) = x$ on the interval [0, 2].

(a) Sketch R. [4 marks]

(b) Calculate the area of R. [5 marks]

(c) Using the method of washers, find the volume of the solid generated when R is revolved around the x-axis. [6 marks]

Question 6

(a) Solve $\frac{dy}{dx} - xe^y = 2e^y$ given initial condition $y(0) = 0$. [6 marks]

(b) Solve the following differential equations:

(i) $y''+11y'+24y = 0$, $y(0) = 0$, $y'(0) = -7$. [7 marks]

(ii) $y''+16y = 0$, $y(\pi/2) = -10$, $y'(\pi/2) = 3$. [7 marks]

End of Paper